

The genus *Hyalomma* Koch, 1844. III. Redescription of the adults and larva of *H. (Euhyalomma) impressum* Koch, 1844 (Acari: Ixodidae) with a first description of its nymph and notes on its biology

Dmitry A. Apanaskevich¹ and Ivan G. Horak²

¹United States National Tick Collection, Institute of Arthropodology and Parasitology, Georgia Southern University, Statesboro, GA 30460-8056, USA;

²Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, 0110, South Africa, and Division of Parasitology, Onderstepoort Veterinary Institute, Onderstepoort, 0110, South Africa

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Abstract. In respect of its morphology, biology and epidemiology, *Hyalomma (Euhyalomma) impressum* Koch, 1844 is one of the more poorly studied ticks of the genus *Hyalomma* Koch, 1844. No comprehensive morphological study has been done to date, and the nymph has not been described. Here the adults and larva are redescribed, and the nymph is described for the first time. Data on hosts, geographical distribution and disease relationships are provided.

Hyalomma (Euhyalomma) impressum Koch, 1844 was originally described as an independent species (Koch 1844). However, Neumann (1901) considered it to be a variety of the catchall species *Hyalomma aegyptium* (Linnaeus, 1758). Schulze (1919) and Schulze and Schlottke (1930) recognized *H. impressum* as a polytypic species and included *Hyalomma truncatum* Koch, 1844, *Hyalomma marginatum rufipes* Koch, 1844, and other synonymous names as subspecies or forms. The subsequent works on the adults of *H. impressum* by Delpy (1949), Feldman-Muhsam (1954) and Hoogstraal (1956) more precisely defined its specific status.

Despite the presence of quite distinct characters in the male, making it easily recognizable from other *Hyalomma* species, there are still some difficulties associated with the identification of adults. For instance, *H. impressum* adults are often mistaken for those of *H. m. rufipes*. Adults of the latter tick also have a punctate scutum and conscutum and there has been a tendency to mistake *H. impressum* for *H. m. rufipes*, or combine the two. This led Russian ixodologists, who followed the suggestions of Pomerantsev (1946, 1950), to consider *H. m. rufipes* collected in the former USSR as being *Hyalomma marginatum impressum* Pomerantsev, 1946 or *Hyalomma plumbeum impressum* Pomerantsev, 1946. The adults of *H. impressum* sometimes also resemble those of heavily punctate *H. truncatum*. Specific identification of the immature stages has been impossible to date.

The aim of this study is to redescribe the adults and larva of *H. impressum* and to describe the nymph for the first time. This should assist parasitologists and epidemiologists in their studies on the biology and medico-veterinary importance of this poorly known *Hyalomma* species.

MATERIALS AND METHODS

A total of 137 males, 22 females, 5 nymphs, and 35 larvae that originated from Egypt, Central African Republic, Mali, Nigeria, Senegal and Sudan were examined in the current study. Both field-collected and laboratory-reared specimens were studied. The type specimen has also been examined by the senior author (DAA). The specimens that were examined are housed in the United States National Tick Collection (Institute of Arthropodology and Parasitology, Georgia Southern University, Statesboro, USA), the Zoological Institute of the Russian Academy of Sciences (St. Petersburg, Russia), the Natural History Museum of Berlin (Berlin, Germany), the Gertrud Theiler Tick Museum at the Onderstepoort Veterinary Institute (Onderstepoort, South Africa) and in the personal tick collection of Dr. J.B. Walker (South Africa).

The immature stages and the finer structures of the adults were mounted on glass slides and examined under a light microscope, and the macrostructures of males and females under a stereoscopic microscope. The spiracular plate of the nymph was studied using a scanning electron microscope. Measurements for the male conscutum and female scutum are given in millimetres (mm), and those for the immature stages in micrometres (µm). The measurements are arranged as follows: minimum–maximum (average ± standard deviation, n = number of specimens measured), and their schematic layout is to be found in Apanaskevich (2003), and Apanaskevich and Horak (2006).

RESULTS

Hyalomma (Euhyalomma) impressum Koch, 1844
Figs. 1–7

Type specimens: the original description was based on specimens (♂♀) from Senegal (“Senegal”, p. 221, Koch 1844). The type specimen (1♂, Senegal, leg.

Mion, Type, ZMB 1071) is deposited in the Natural History Museum of Berlin (Berlin, Germany).

Synonyms (Camicas et al. 1998 with corrections):

Hyalomma aegyptium var. *impressum* Koch, 1844 *sensu* Neumann 1901;

Hyalomma aegyptium impressum Koch, 1844 *sensu* Neumann 1911;

Hyalomma aegyptium impressum f. *typica* Schulze, 1919;

Hyalomma impressum impressum Koch, 1844 *sensu* Schulze and Schlottke 1930;

Hyalomma dromedarii impressa Koch, 1844 *sensu* Neveu-Lemaire 1938;

Hyalomma savignyi intermedia Rousselot, 1946;

Hyalomma dromedarii impressum Koch, 1844 *sensu* Curasson 1947

Descriptions and illustrations of adults are available in a number of publications and we consider the most useful of these to be found in Feldman-Muhsam (1954) and Hoogstraal (1956). The larva is illustrated and described in Camicas (1970). The nymph has never been described.

Description

Male

Figs. 1, 2A–H, 3A

Conscutum (Fig. 1): length 3.26–4.30 (3.83 ± 0.21 , $n = 119$), width 2.02–2.70 (2.34 ± 0.13 , $n = 119$), ratio length:width 1.48–1.77 (1.64 ± 0.05 , $n = 119$); dark red-brown in colour; pale marbling absent; narrowly oval in shape; widest near mid-length; pronounced narrowing in region of spiracular plates; cervical and lateral grooves superficial, up to 1/3 length of conscutum; marginal grooves short, furrow-like, extending to posterior 1/3 of conscutum, however, dense and deep punctations aligned with marginal groove give it appearance of a long but shallow groove almost 2/3's of conscutum length; posteromedian and paramedian grooves poorly defined, obscured by dense punctations; caudal field poorly defined; medium-sized punctations fairly evenly dispersed over conscutum, more dense, often contiguous on caudal field, less dense on elevations demarcating this field; parma absent; 5 distinct festoons. *Genital structures* (Fig. 2A) as illustrated. *Anal shields* (Fig. 2B): 3 pairs; adanal plates long, broad, tapering slightly posterior to median projection, lateral margin slightly convex, anteriomedian margin concave, median projection fairly distinct, posteriomedian margin straight; subanal plates variable both in size and shape, usually small, rounded and longitudinally aligned. Ventral sclerotized plaque absent on median but present on paramedian festoons. *Spiracular plate* (Fig. 2C): dorsal prolongation long and clearly distinct from body of plate; perforated portion of prolongation straight, curving at its apex, relatively broad. Circumspiracular setae sparse.

Basis capituli (Fig. 2D, E): without lateral projections; dorsal posterior margin slightly concave or straight; cornua moderate. *Palpi* (Fig. 2F): segment I

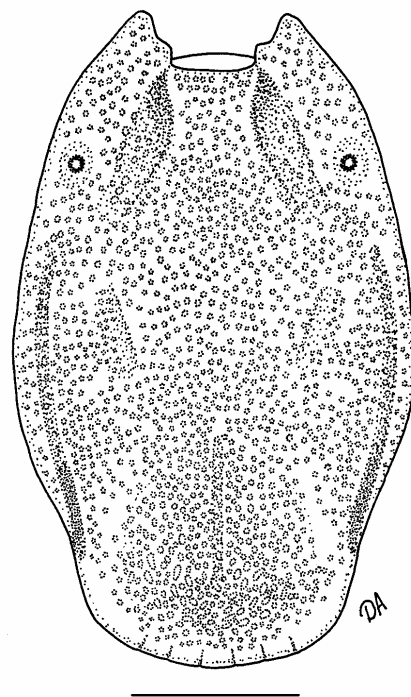


Fig. 1. *Hyalomma impressum*, male, conscutum. Scale bar = 1 mm.

with more than 5 ventromedian setae. *Hypostome* (Fig. 2G): club-shaped; denticulate portion slightly longer than denticle-free portion (small scale-like projections posterior to last large denticle are not considered denticles).

Coxae (Fig. 2H): posteromedian and posterolateral spurs of coxae I long, close together, tapering to apices; coxae II–IV each with distinct, triangular, posterolateral spur with rounded apex; coxae II and III each with poorly developed, broadly arcuate, posteromedian spur; internal spur on coxa IV distinct, triangular. Ivory-coloured enamel band encircles distal portion of each segment of the legs (Fig. 3A).

Female

Figs. 3B, 4, 5A–G

Scutum (Fig. 4): length 1.97–2.42 (2.20 ± 0.12 , $n = 16$), width 1.99–2.45 (2.19 ± 0.13 , $n = 16$), ratio length:width 0.97–1.06 (1.01 ± 0.03 , $n = 16$); dark red-brown to nearly black in colour; pale marbling absent; nearly as long as broad; posterolateral angles slight; cervical and lateral grooves moderately deep, extending to posterior margin of scutum; medium-sized punctations dense, deep, uniformly covering scutum. *Genital structures* (Fig. 5A): genital aperture relatively narrow, deep, rounded (U-shaped); vestibular portion of vagina bulging. *Spiracular plates* (Fig. 5B): perforated portion of dorsal prolongation curved and relatively broad. Circumspiracular setae sparse.

Basis capituli (Fig. 5C, D): dorsally lateral projections short, absent ventrally; dorsal posterior margin straight; dorsal cornua inconspicuous. *Palpi* (Fig. 5E):

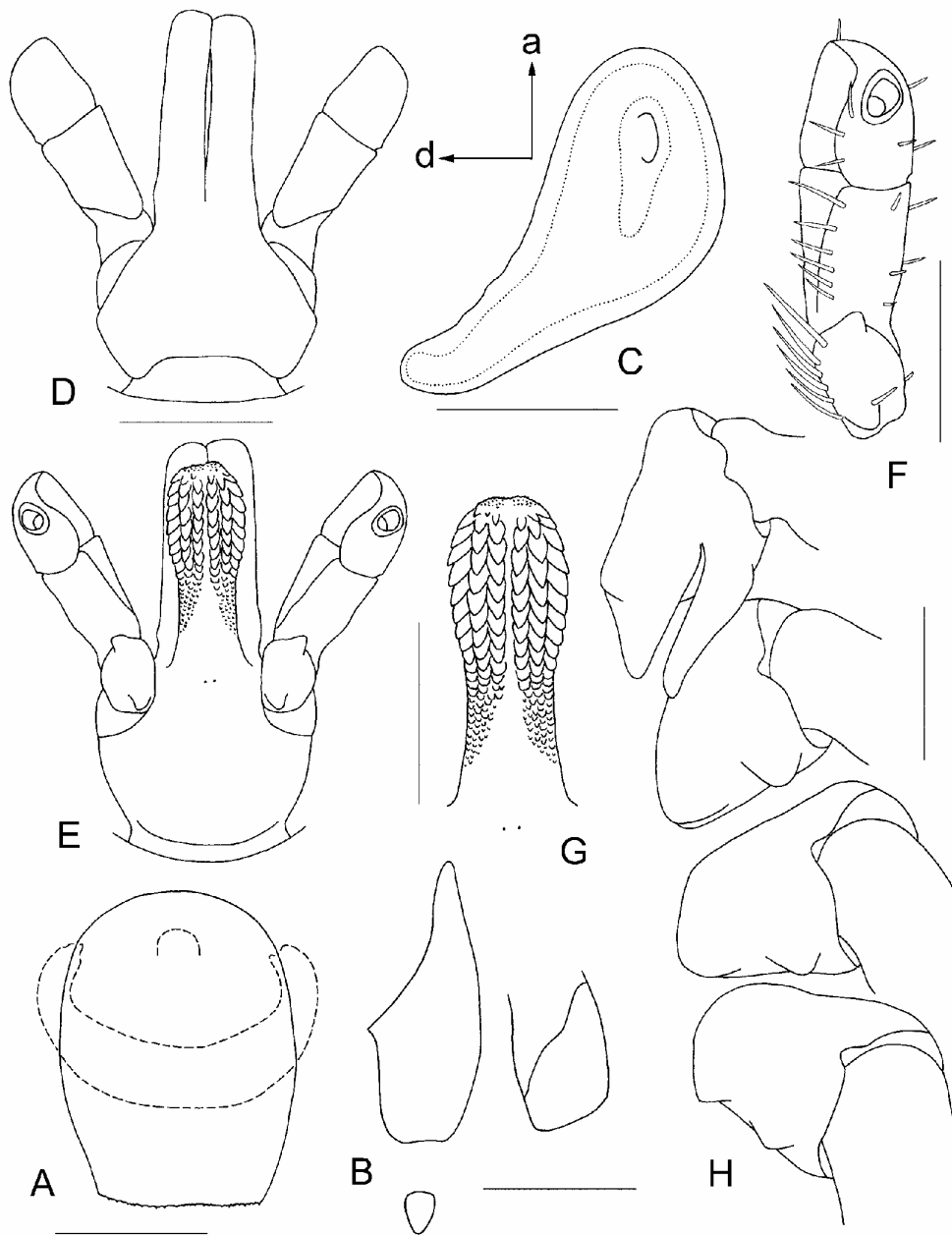


Fig. 2. *Hyalomma impressum*, male. **A** – genital structures; **B** – anal plates; **C** – spiracular plate (a – anterior, d – dorsal); **D** – gnathosoma dorsally; **E** – gnathosoma ventrally; **F** – palp ventrally; **G** – hypostome; **H** – coxae. All setation is omitted except drawing F where only setae of segment IV are omitted. Scale bars: A = 200 μ m; B, D, E, H = 500 μ m; C, F, G = 400 μ m.

segment I with more than 5 ventromedian setae. *Hypostome* (Fig. 5F): club-shaped; denticulate portion slightly longer than denticle-free portion.

Coxae (Fig. 5G): posteromedian and posterolateral spurs of coxa I long, tapering to apices, close together; coxae II–IV each with distinct, broadly triangular posterolateral spur, with rounded apex; coxae II–IV each with poorly developed, broadly arcuate, posteromedian spur. Colouration of legs similar to that of male (Fig. 3B).

Nymph

Scutum (Fig. 6A): length 615–634 (625 ± 13.80 , $n = 2$), width 683–693 (688 ± 6.90 , $n = 2$), ratio length:width 0.89–0.93 (0.91 ± 0.03 , $n = 2$), distance between posterior margin of eyes and posterior margin of scutum 224–234 (229 ± 6.90 , $n = 2$), ratio width:length of posterior portion of scutum 2.92–3.09 (3.00 ± 0.12 , $n = 2$); posterior margin of scutum very narrowly rounded; posterolateral depressions on either side of scutal apex almost invisible. *Setae of alloscutum* (Fig. 6B): without

Fig. 6A–F

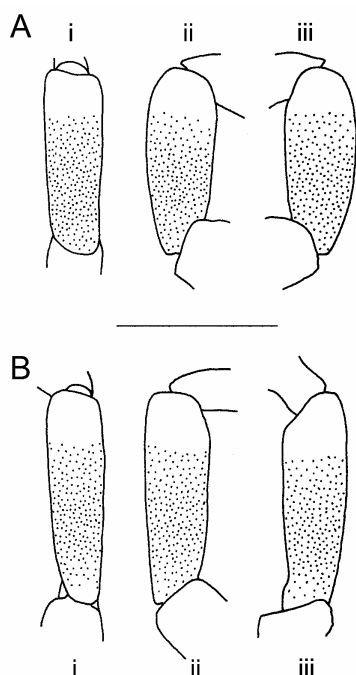


Fig. 3. *Hyalomma impressum*, genu IV. **A** – male: i – dorsal view, ii – lateral view, iii – medial view; **B** – female: i – dorsal view, ii – lateral view, iii – medial view. Scale bar = 1 mm.

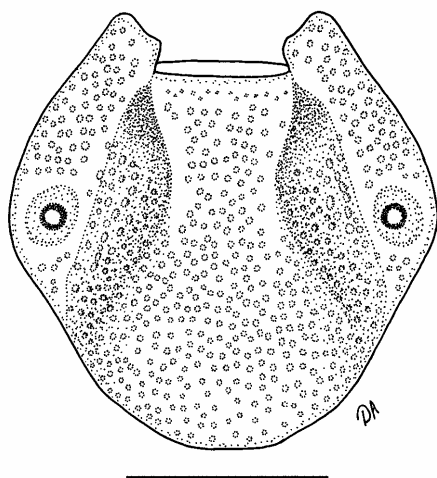


Fig. 4. *Hyalomma impressum*, female, scutum. Scale bar = 1 mm.

denticles, narrowing to rounded apex. *Spiracular plates* (Fig. 6C): oval; dorsal prolongation distinct, broad, blunt at apex; submarginal row of perforations complete.

Basis capituli (Fig. 6D, E): length 410–415 (412 ± 3.53 , $n = 2$); width 375 ($n = 2$), ratio length:width 1.09–1.11 (1.10 ± 0.01 , $n = 2$). *Palpi* (segment II) (Fig. 6D, E): length 199–202 (200 ± 1.70 , $n = 2$), width 65–70 (67 ± 3.39 , $n = 2$), ratio length:width 2.90–3.07 ($2.98 \pm$

0.12, $n = 2$); palpal segment II proximally narrow, gradually expanding distally. *Hypostome* (Fig. 6E): length 214–223 (218 ± 6.79 , $n = 2$), width 82 ($n = 2$), ratio length:width 2.62–2.73 (2.68 ± 0.08 , $n = 2$); median file with 7 or 8 large denticles; transition of denticulate portion to denticle-free portion gradual; denticulate portion more than twice as long as denticle-free portion.

Coxae (Fig. 6F): coxa I with long, narrow, subtriangular spurs nearly equal in length; coxae II–IV each with moderate spur, spurs conspicuously decreasing in size from coxae II to IV; coxal pore present.

Larva

Fig. 7A–D

Scutum (Fig. 7A): length 217–245 (233 ± 5.44 , $n = 34$), width 330–370 (344 ± 9.07 , $n = 34$), ratio length:width 0.59–0.71 (0.68 ± 0.02 , $n = 34$), distance from posterior margin of eyes to posterior margin of scutum 50–62 (57 ± 3.47 , $n = 34$), ratio width:length of posterior portion 5.28–6.80 (6.03 ± 0.39 , $n = 34$). Portion of scutum posterior to eyes equal to 1/4 of scutal length; posterior margin of scutum broadly rounded with distinct posterolateral depressions on either side of apex.

Basis capituli (Figs. 7B, C): 149–163 (155 ± 3.43 , $n = 34$); subhexagonal dorsally; subtriangular ventrally; apex of dorsolateral projections directed slightly anteriorly; lateral projections distinct and appear acute from ventral view. *Palpi* (segments II and III) (Fig. 7B, C): length 98–108 (103 ± 2.20 , $n = 34$), width 38–43 (40 ± 0.87 , $n = 34$), ratio length:width 2.41–2.67 (2.55 ± 0.06 , $n = 34$). *Hypostome* (Fig. 7C): length 77–89 (81 ± 2.69 , $n = 34$), width 24–28 (25 ± 0.90 , $n = 34$), ratio length:width 3.00–3.50 (3.19 ± 0.12 , $n = 34$); median file with 5 large denticles; transition of denticulate portion to denticle-free portion abrupt; denticulate portion approximately 1/2 of hypostome length.

Coxae (Fig. 7D): coxa I with small, subtriangular spur, with rounded apex; coxae II–III each with small, fold-like, indistinct spur. *Genua I*: length 130–149 (140 ± 3.97 , $n = 34$), width 43–48 (47 ± 1.49 , $n = 24$), ratio length:width 2.70–3.22 (3.00 ± 0.11 , $n = 24$).

Related species

The phylogenetic position of *H. impressum* is unclear. The narrowing of the conscutum at the level of the spiracular plates in the male places it close to the *H. truncatum* group of species. Because *H. impressum* shares parts of its distribution range with *H. anatolicum* Koch, 1844, *H. dromedarii* Koch, 1844, *H. excavatum* Koch, 1844, *H. impeltatum* Schulze et Schlottke, 1930, *H. marginatum rufipes*, *H. nitidum* Schulze, 1919 and *H. truncatum*, it is important to differentiate it from these ticks.

Males of *H. impressum* are distinguished from the other sympatric *Hyalomma* species by a combination of the following characters: prominent narrowing of the conscutum at the level of the spiracular plates, puncta-

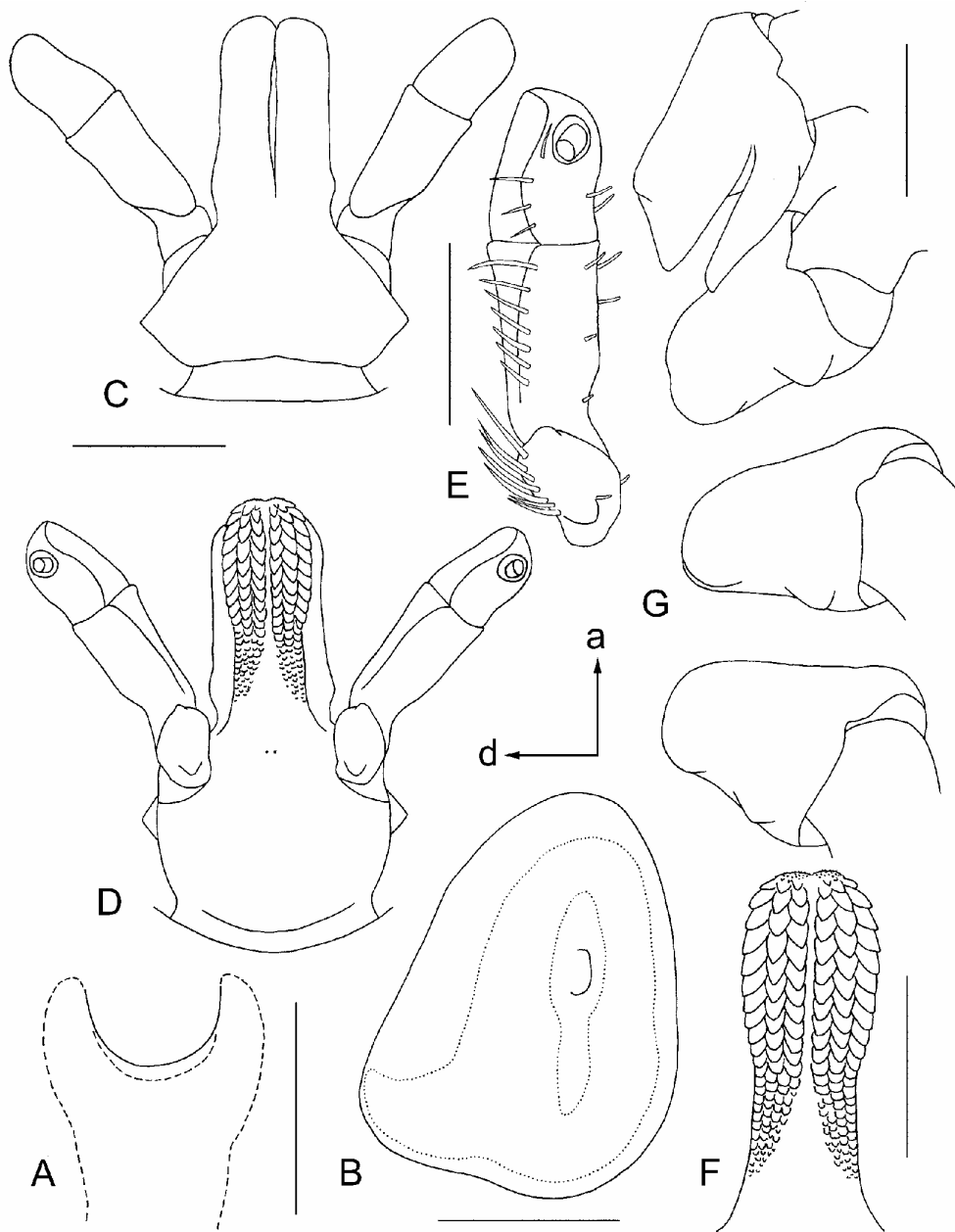


Fig. 5. *Hyalomma impressum*, female. **A** – genital structures; **B** – spiracular plate (a – anterior, d – dorsal); **C** – gnathosoma dorsally; **D** – gnathosoma ventrally; **E** – palp ventrally; **F** – hypostome; **G** – coxae. All setation is omitted except drawing E where only setae of segment IV are omitted. Scale bars: A = 200 μ m; B, E, F = 400 μ m; D, C, G = 500 μ m.

tion of conscutum dense and deep, perforated portion of dorsal prolongation of spiracular plates relatively broad, circumspiracular setae sparse.

Females of *H. impressum* can be distinguished from the other sympatric *Hyalomma* species by a combination of the following characters: punctuation of scutum dense and deep, genital operculum narrowly arcuate, vestibular part of vagina bulging, perforated portion of dorsal prolongation of spiracular plates relatively broad, circumspiracular setae sparse.

Superficially, the nymphs of *H. impressum* resemble those of *H. truncatum* and *H. nitidum*, but can easily be

distinguished from them by the narrowly pointed posterior margin of the scutum with indistinct posterolateral depressions. Of the sympatric species only the nymphs of *H. impeltatum* have a similarly shaped scutum. The nymphs of *H. impressum* can be distinguished from those of *H. impeltatum* by their larger size and the proportions of various structures, such as scutum, gnathosoma, palpi and hypostome, a more denticulate hypostome and larger spurs on the coxae.

The shape and size of the posterior portion of the scutum of larvae of *H. impressum* are similar to those of *H. anatolicum* and *H. excavatum* in one respect and

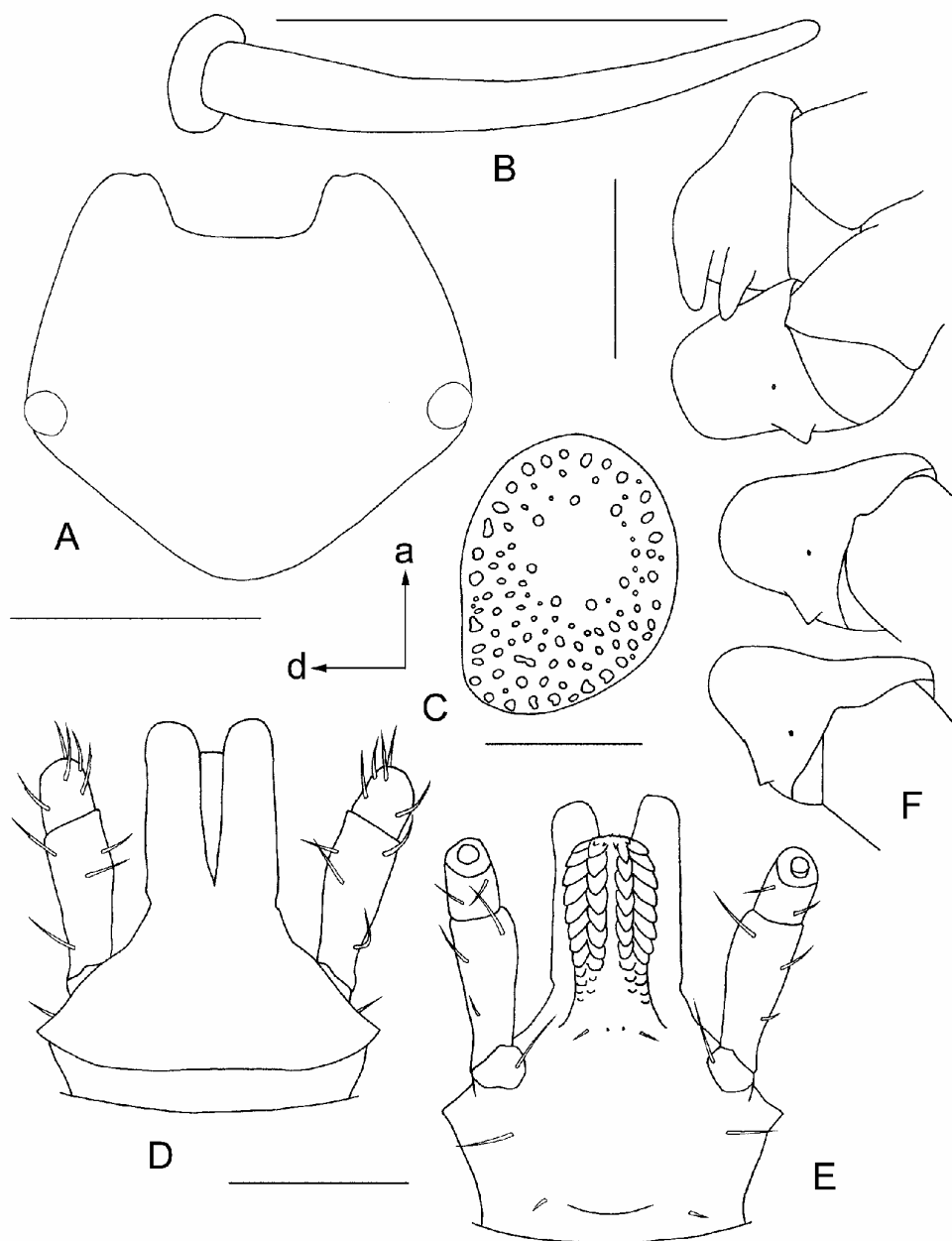


Fig. 6. *Hyalomma impressum*, nymph. **A** – scutum; **B** – setae of alloscutum; **C** – spiracular plate (a – anterior, d – dorsal); **D** – gnathosoma dorsally; **E** – gnathosoma ventrally; **F** – coxae. All setation is omitted except drawings D and E where only setae of segment IV are omitted. Scale bars: A = 400 μ m; B, C = 50 μ m; D, E, F = 200 μ m.

to those of *H. dromedarii* and *H. impeltatum* in another. The larvae of *H. impressum* can be distinguished from those of other sympatric *Hyalomma* species by the small spur with rounded apex on coxa I and very small, fold-like spurs on coxae II and III.

Hosts

Hyalomma impressum is a three-host species (Centurrier 1982). Adults have been collected from cattle, camels, sheep, horses, pigs and dogs (our data; Hoogstraal 1956, Morel 1958, Theiler 1962, Kolonin 1983). The only wild hosts recorded to date are warthogs, *Phaco-*

choerus aethiopicus (Pallas) (Morel 1958). Two larvae have been found on *Atelerix albiventris* (Wagner) and *Arvicanthis niloticus* (Desmarest) (Camicas 1970).

Zoogeography

Known distribution of *H. impressum* is entirely confined to the Ethiopian zoogeographic region. Africa: Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Ivory Coast, Mali, Niger, Nigeria, Senegal and Sudan (our data; Hoogstraal 1956, Morel 1958, Theiler 1962, Elbl and Anastos 1966, Kolonin 1983). Hoogstraal and Kai-

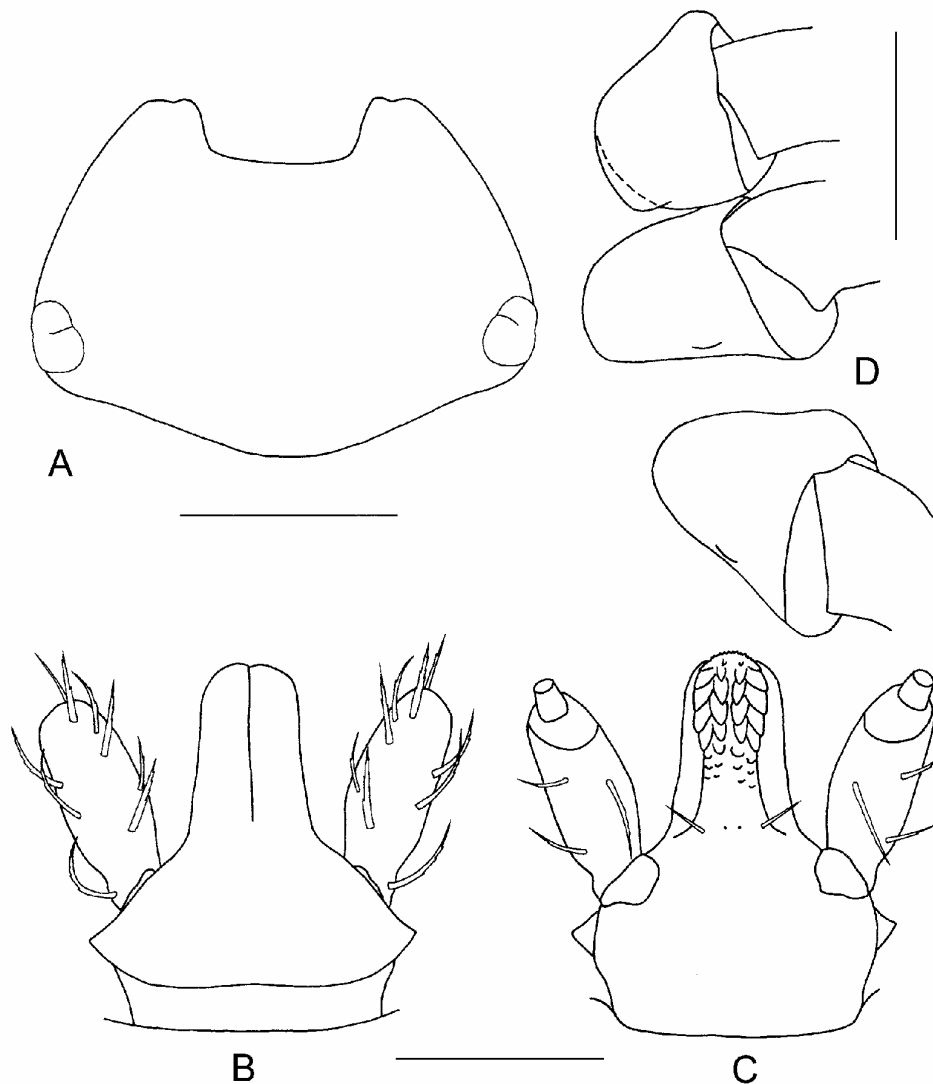


Fig. 7. *Hyalomma impressum*, larva. **A** – scutum; **B** – gnathosoma dorsally; **C** – gnathosoma ventrally; **D** – coxae. All setation is omitted except drawings B and C where only setae of segment IV are omitted. Scale bars: A = 150 µm; B, C, D = 100 µm.

ser (1958) recorded *H. impressum* from Egypt, but stated that it was of introduced origin. The record of *H. impressum* from Eritrea (Tonelli Rondelli 1930) needs to be confirmed.

Disease relationships

Little is known concerning the vector capacity of *H. impressum*. Two strains of Crimean-Congo haemorrhagic fever virus have been isolated from it in Senegal (Hoogstraal 1979), and Dipeolu and Amoo (1984) have recorded the presence of *Babesia* sp. kinetes in *H. impressum* in Nigeria.

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